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COMPARISON OF CONVENTIONAL SENSOR WITH SINGLE MODE OPTICAL FIBER SENSOR FOR MONITORING OF PARTIAL DISCHARGE IN OIL INSULATION

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This project is dedicated to my family for their endless support and encouragement.

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ABSTRACT

High-voltage transformer is the most critical and expensive component in a power system network in order to ensure the stability of the system. Partial discharge (PD) is small electrical sparks present in an insulator as result of the electrical breakdown of a gas (for example air) contained within a void or in a highly non-uniform electric field. Partial discharge (PD) phenomenon is one of the reasons that happen in high voltage appliances and lead to failure of power transformer, leading to expensive repair and power outage. An acoustic emission (AE) phenomenon also happens near the discharge zone that is used to detect (PD).Partial discharge detection is a technique widely used for high voltage equipment insulation condition monitoring and assessment. Many researchers have used acoustic emissions (AE) at the vicinity of the discharge zones to detect PD. This project compares the sensitivity of single mode fiber optical sensor with capacitive sensor. The fiber optical sensor (FOS) and capacitive sensor were immersed in an oil tank fitted with two steel electrodes which were connected to different values of high voltage source. The data obtained by both sensors were then analyzed in time and frequency domain, and compared by peak analysis that suggest that single mode optical fiber was able to act as acoustic sensor with large wide band of signals. These experimental results are interesting which also suggest that both sensors have peculiar characteristics for the detection of AE and could be used as per the PD detection requirements.

ABSTRAK

Pengubah voltan tinggi adalah komponen yang paling kritikal dan mahal dalam rangkaian sistem kuasa bagi memastikan kestabilan sistem. Pelepasan separa (PD) adalah percikan api kecil elektrik hadir dalam penebat akibat kerosakan elektrik gas (sebagai contoh udara) yang terkandung dalam kekosongan atau dalam medan elektrik sangat tidak seragam. Pelepasan separa (PD) fenomena adalah salah satu daripada sebab-sebab yang berlaku dalam peralatan voltan tinggi dan membawa kepada kegagalan kuasa pengubah , yang membawa kepada pembaikan mahal dan gangguan kuasa . Akustik pelepasan (AE) fenomena juga berlaku berhampiran zon pelepasan yang digunakan untuk mengesan (PD) . Pengesanan pelepasan separa adalah satu teknik yang digunakan secara meluas untuk voltan tinggi penebat peralatan pemantauan keadaan dan penilaian. Ramai penyelidik telah menggunakan pelepasan akustik (AE) di sekitar zon pelepasan untuk mengesan PD. Projek ini membandingkan sensitiviti serat mod tunggal sensor optik dengan sensor kapasitif. Serat optik sensor (FOS) dan sensor kapasitif telah direndam di dalam tangki minyak yang dipasang dengan dua elektrod keluli yang telah disambungkan ke nilai yang berbeza daripada sumber voltan tinggi. Data yang diperolehi oleh kedua-dua sensor kemudiannya dianalisis dalam domain masa dan frekuensi , dan dibandingkan dengan analisis puncak yang mencadangkan bahawa mod tunggal gentian optik mampu untuk bertindak sebagai sensor akustik dengan band besar luas isyarat. Keputusan ini eksperimen adalah menarik yang juga mencadangkan bahawa kedua-dua sensor mempunyai ciri-ciri khusus untuk mengesan AE dan boleh digunakan sebagai satu keperluan pengesanan PD.